GPRA Representation of the Wind and Hydropower Technologies Program

The wind component of the Wind and Hydropower Program seeks to reduce the cost and improve the performance of wind generation. The GPRA benefits are based primarily on projecting the market share for wind technologies based on their economic characteristics. The hydropower program goal is to reduce the environmental impact of hydroelectric facilities. Because this program is driven more by environmental than economic concerns, a program office estimate for the market penetration is the primary source for the GPRA benefits estimate.

The NEMS-GPRA04 electricity sector module performs an economic analysis of alternative technologies in each of 13 regions. Within each region, new capacity is selected based on its relative capital and operating costs, its operating performance (i.e. availability), the regional load requirements, and existing capacity resources. Wind is characterized by three wind classes, although the best wind class is assumed to developed first within each region. Other key assumptions that can affect projections include a limit on the share of generation in each region that can be met with intermittent technologies. This was raised from a limit of 12 percent that is used by EIA in the AEO2002 to a limit of 30 percent based on experience in other countries and the program office expectations. Another assumption is how quickly the wind industry can expand before costs rise due to manufacturing bottlenecks. This was raised from 50 percent of installed wind capacity to 100 percent. Both of these assumptions were changed for the Baseline and GPRA cases, although they have no impact on the Baseline case.

The wind program was represented by reducing the capital and O&M costs for wind to match the program cost goals, as updated in the summer of 2001. In addition to competing on an economic basis with other electricity generation technologies, wind capacity may be constructed for its environmental benefit. The PERI Green Power Market Model was used to estimate the potential demand for renewable generation, including wind, in response to the expanding green power markets in many places across the country. The projections for green power wind installations were incorporated into NEMS-GPRA04 as the planned capacity additions.

The expectation of the hydropower program office is that future hydro capacity and generation will decrease due to environmental concerns as facilities undergo relicensing. The program goal is to develop hydro turbines that reduce fish mortality rates and therefore reduce the risk of these capacity reductions. The original Baseline projected relatively constant hydropower, implying that the technology was already assumed to be deployed or that the issue had not been examined. As a result, the final Baseline for GPRA was modified to reflect an estimate of hydro capacity and generation lost in the absence of the fish-friendly turbines. The GPRA program case then returned hydropower to the prior constant levels, and the benefits result from the increased hydro output.

Estimates of primary energy, oil, and carbon emissions savings stem from wind and hydropower displacing fossil-fueled generation sources that were built in the Baseline case. Over time, the new facilities that are constructed in the Baseline become more efficient as gas combined cycle and combustion turbine technologies continue to improve. As a result the energy and emission savings from the central grid decline per kilowatt-hour of renewable generation. Energy expenditure savings are measured as the reduction in consumer expenditures for electricity and other fuels. Lower cost renewable generation options reduce the price of electricity directly and reduce the pressure on natural gas supply, both of which benefit end-use consumers.

The renewable programs have been modeled together, and the GPRA benefits are allocated to each proportional to their generation share.

FY04 GPRA Benefits Estimates for Wind & Hydropower (NEMS-GPRA04)			
	2005	**2010**	**2020**
Capacity (GW)	1.3	4.6	37.6
Generation (GWh)	5.0	17.3	156.5
Energy Savings (quads)	0.05	0.13	1.17
Oil Savings (quads)	0.01	0.01	0.07
Carbon Savings (MMT)	0.8	2.1	21.0
Energy Expenditure Savings (B2000$)	0.2	0.8	4.8